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SELECTIONS FROM THE RECORDS OF THE BOMBAY GOVERNMENT.

No. XLII.—New Series.

REPORT OF CAPTAIN W. L. MEREWETHER,

ACTING POLITICAL SUPERINTENDENT, FRONTIER OF UPPER SIND,

WITH OTHER PAPERS,

RELATING TO THE

110052

ENLARGEMENT OF THE BIGAREE CANAL,

IN UPPER SIND.

Bombay:
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THE BIGAREE CANAL, UPPER SIND.

No. 462 of 1856.

Public Works Department.

From Lieutenant Colonel John Jacob, C.B.,
Acting Commissioner in Sind,

To the Right Honorable Lord Elphinstone, G.C.H.,
Governor and President in Council, Bombay.

Dated 6th December 1856.

My Lord,—With reference to former correspondence (ending with the Government Resolution No. 2575, dated 24th September 1856), I have the honour to transmit to your Lordship in Council the accompanying report by Captain Merewether on the Bigaree Canal, the most important irrigational work as yet executed by the British Government in Sind;—a work which was projected, commenced, and in great part executed by myself, as Political Superintendent on the Frontier, and which has now been most admirably completed by my excellent Lieutenant, Captain Merewether.

2. To the report is appended some correspondence relating to the work and effects of the canal.

3. Little further observation seems to be called for from me, but I beg leave respectfully to commend to the favourable notice of Government the most successful exertions displayed in the execution of this great work by Captain Merewether, whose zeal, energy, and perseverance in its performance I cannot praise too highly.

4. I beg leave also to call attention to the merits of Kardar Khyr Shah, who is mentioned with such commendation by Captain Merewether. I am personally well acquainted with this Kardar.

I entirely concur in the opinion expressed by Captain Merewether of his high merits; and I beg, therefore, to recommend that I may be authorised, on this occasion, to make him a present of a horse and a shawl, of an aggregate value not exceeding Rs. 500, which would, I am convinced, be attended with excellent effect in this country, where it is of the greatest importance to obtain the cordial co-operation, and to develope the working qualities of such men as Khyr Shah, who is a Syud of very good family, of high repute, and of considerable influence.

5. Finally, I would respectfully suggest that it might be useful if your Lordship in Council were pleased to direct that this report, with the map, &c. be printed.

I have the honour to be, &c.

(Signed) JOHN JACOB, Lieutenant Colonel,
Acting Commissioner in Sind.

Commissioner's Office, Camp Jacobabad, 6th December 1856.

P.S.—For easy reference, I have appended copies of correspondence relative to this canal, part of which has already been laid before Government.

(Signed) JOHN JACOB, Lieutenant Colonel,
Acting Commissioner in Sind.

No. 1065 OF 1851.

TERRITORIAL DEPARTMENT, REVENUE.

From the COMMISSIONER IN SIND,

To the Right Honorable Lord Viscount FALKLAND,
Governor and President in Council, Bombay.

Dated 10th June 1851.

MY LORD,—I have the honour to report that when I was at Khanghur Major Jacob brought to my notice the immense benefit which would result to all the country north of Shikarpoor if the Bigaree Canal were deepened and widened, so as to enable it to convey a greater body of water.

2. An inspection of Major Jacob's published map of "Cutchee and the North-West Frontier of Sind" will show your Lordship in Council, better than any description I can give, the direction of this canal (which is one of the principal in Upper Sind), and the present distribution of its water.

3. It will be seen from the map that, after leaving the Indus, the Bigaree runs nearly due west, giving off on its northern side a number of smaller canals, which run in a direction generally north or north-west, till they thin out and terminate about the edge of the Desert.

4. It will be remembered that the surface of this tract of country gradually slopes from the Indus, so that the water which, at the spot where the canal branches off from the Indus, is many feet below the surface, after running forty or fifty miles comes out close to, or on the surface.

5. Hence, the further the canal recedes from the river the nearer is the water to the surface, and the greater are the facilities for raising it, till at length, near the borders of the Desert, it may, during the height of the inundation, be allowed to flow over the fields, without the expense of any wheels or other contrivance for raising it.

6. The soil throughout is naturally good, but, like most soils in Sind, it becomes intensely salt if left untilled and unirrigated; and almost all the wells in the country become either perfectly salt or more or less brackish.

7. At present newly cultivated land near the Desert will, from the extreme saltness of the soil, produce little but certain varieties of jowaree.

8. Tillage and irrigation will, however, in the course of a few seasons, almost entirely free the land from salt, with the exception of occasional incurable patches; and by assiduous use of the wells, and by turning into them the water from the canals, the most brackish wells become annually improved, till in the third or fourth year they remain sweet all the year through.

9. These facts have been repeatedly proved in all kinds of situations, and under every variety of circumstance, by Major Jacob, since the settlement of this frontier, and there cannot be a doubt but that the whole of the district between Shikarpoor and the Desert might become again, as it has been in more prosperous times, a sheet of cultivation.

10. There are men now living who remember it so cultivated, and the marks of such former cultivation are everywhere now visible.

11. Of late years, as your Lordship in Council is aware, the Frontier tribes have ravaged and desolated the country up to the gates of Shikarpoor. The few inhabitants who remained were almost as lawless as their neighbours, and lived more by retaliatory plunder than by honest labour.

12. Since Major Jacob took charge of the Frontier, this state of things has been completely changed. He has rigidly enforced the disarming of all within our Frontier, and has put down the practice of forays beyond our Frontier, whilst his posts of Sind Irregular Horse form a perfect cordon of protection to all within them against aggression from without.

13. In going from Shikarpoor to Khanghur, I passed over the district: less than four years ago it was exposed to be ravaged by forays of Hill Beloochees, who kept even the Brigade of Shikarpoor in constant alarm of an attack, and who, within the period in question, carried off from that district a large booty, undeterred by a strong detachment of the Brigade, which went in pursuit of them.

14. It was impossible not to be struck with the present altered state of things. Single unarmed travellers seemed now as safe as elsewhere in Sind, and the general sense of perfect security was shown by the improving state of the villages, and the fact that the people now trust themselves, their cattle, and grain-yards, day and night, out in the open fields, instead of keeping, as was so lately their invariable custom, under shelter of their village walls.

15. All were loud in proclaiming their gratitude for the present perfect peace and security assured to them by Major Jacob's arrangements.

16. Nothing further is now wanting to restore the country to its ancient state of prosperity than to give it its ancient supply of water.

17. To do this in the large district traversed by the Bigaree and its branches, nothing more is requisite, on the part of Government, than to deepen and widen the Bigaree, the great artery of irrigation, leaving the cultivators along its course to improve, in a similar manner, the smaller branch canals which convey the water to their fields.

18. The details of the additional capacity which Major Jacob proposes to give the canal are fully stated in the enclosures. The total expense he estimates at Rs. 1,30,094, which he proposes to divide between the English Government and His Highness Meer Ali Morad, in proportion to the benefit each will derive, so that Rs. 97,570 will be ultimately defrayed by us, and Rs. 32,524 by His Highness.

From—
No. 73, dated 1st April 1851, with an enclosed Estimate.
To—
No. 541, dated 11th ditto.
From—
No. 87, dated 21st ditto.

19. The return will be, at a very moderate calculation, an increase of revenue of about Rs. 89,000 to the British Government, and Rs. 30,000 to His Highness Meer Ali Morad.

20. But it is not only in directly increased revenue that the benefits of the improvement will be felt.

21. An extended and improved supply of drinking water for man and beast, and better grazing, will tell indirectly, but very decidedly, on the prosperity of the cultivators throughout the district.

22. Still more decided will be the moral effect on the people of the country,—it will give the means of subsistence to many thousands, and thereby, like every such measure, strengthen our Government: more especially the reclaimed tribes of Hill Beloochees, whose colonies are all, with few exceptions, on the canals fed by the Bigaree, will find their means of profitable cultivation greatly increased.

23. Those who are under Major Jacob's immediate influence have already shown an excellent spirit in this respect. I have now before me, in a private letter from Major Jacob, an account of some late proceedings of Jummal Khan Doomkee, once a notorious plundering leader, but since Sir C. Napier's Trukkee Campaign, in which he was made prisoner, settled near Khanghur. He last year obtained from Lieutenant Farrington a grant of waste land near Koomree, the next post to Kusmore, on the Sind Frontier. Here he collected all the idle Beloochees from his own village and Janadeyra, the Jekranee colony near Khanghur, and set them to work on the old canal, which they have dug out, besides making a dam about 50 yards long, and in the centre 30 feet high, very strong and solid, secured with trunks of large trees, &c. to prevent the water of the canal flowing into a hollow. This has been done entirely by men who, ten years ago, would have rather starved than touched a spade or hoe; and yet, when

visited by Major Jacob and his officers, they seemed as proud of their work as they would have formerly been of a successful foray; and even those officers who had encouraged them to the work could hardly have believed that it was executed by Beloochee robbers, putting into their works of peace, as they did formerly into their plundering expeditions, a far greater amount of energy than the Sindee cultivators.

24. I have referred to this case in some detail, because one such instance is worth any amount of the best reasoned speculation as to the probable results of measures like that in question, calculated to afford numerous opportunities for similar improvements. Your Lordship in Council would, I am convinced, think such results cheaply purchased at a considerable outlay of money, and will therefore, I am sure, accord them a place among the profitable returns to be expected from that now recommended.

25. As the Bigaree lies, in part, in those districts of His Highness Meer Ali Morad which form a portion of Major Jacob's political charge, and as it runs almost entirely through frontier districts, I would recommend that the work be placed entirely under Major Jacob's superintendence, the Collector and his Deputies being directed to co-operate with him in every way, more especially by placing at his disposal the ordinary machinery for canal clearances, including, if necessary, the services of his Deputy, Lieutenant Dickson.

26. There can no doubt His Highness Meer Ali Morad would readily consent to bear his share in a project so advantageous to him, but his pecuniary difficulties may prevent him from paying down, or even promising to pay, his share in money. I would recommend, therefore, that the same course be pursued as has, I find, been usually followed in the ordinary annual clearances of this very canal. His Highness furnishes as many statute labourers as he can. If they are fewer than the number at which he is assessed by the Collector, according to the general and long established custom of the country, the deficient men are entertained and paid by the Collector, and His Highness debited with the amount.

27. Your Lordship in Council is well aware that, besides possessing a more minute and accurate acquaintance with the country than any European living, and having brought all his observations to the test of regular scientific survey, Major Jacob is, as a practical Engineer, second to none in the Government service, and I have not

therefore thought it necessary to submit his plan for the criticism of any other officer, simply because I know of none whose scientific attainments are greater, or who could, without the labour of years, add to them so accurate a knowledge of local circumstances.

28. Moreover, the whole plan is so simple, and its results so certain, that there is hardly room for any reasonable difference of opinion, the work being merely the enlargement of an existing canal, and not the excavation of a new one, to the results of which some degree of uncertainty must always attach.

29. I trust I may be pardoned for expressing my respectful opinion that the acknowledgments of Government are due to Major Jacob for maturing and bringing forward a plan which, however closely connected with the great and philanthropic objects he has most at heart, is not one which he was officially bound to take the trouble of bringing forward.

I have the honour to be, &c.

(Signed) H. B. E. FRERE,
Commissioner in Sind.

No. 358 OF 1856.

From the ACTING POLITICAL SUPERINTENDENT,
Frontier of Upper Sind,

To the ACTING COMMISSIONER IN SIND.

Jacobabad, 21st October 1856.

SIR,—I have the honour to forward the accompanying report of the proceedings with regard to the enlargement and extension of the tail of the Bigaree Canal, commenced and completed during the past season.

2. To present a clear view of the advantages that will be derived from this work, as also of the nature and extent of the work done, it will be necessary to refer back a little, and give some account of the improvements made in this canal from the very first.

3. In April 1851 the Political Superintendent on the Frontier of Upper Sind (Major Jacob, C.B.) represented to the Commissioner (Mr. Frere) the great benefits that must follow on the enlargement of the Bigaree, the principal canal in this part of the country. The

reasons are given, and the subject fully discussed in Mr. Frere's letter (Territorial Department, Revenue, No. 1065, of 10th June 1851, of which copy is appended to this report) addressed to the Governor of Bombay.

4. At that time, this canal, though reckoned one of the largest in Upper Sind, was, from the system of annual clearances being in those days very defective, becoming yearly smaller. The supply of water brought down by it was barely adequate for the small amount of then existing cultivation, or for the supply of the inhabitants of the villages dependent on it entirely for drinking water. For want of a sufficiency of fresh water in the soil, the wells in the villages would become salt as brine long before a new inundation brought a fresh supply from the Indus, and the greatest distress sometimes was the result. Hundreds of acres of excellent land also remained waste from the same cause.

5. Major Jacob, the Political Superintendent on the Frontier, had then nothing to do with the civil charge of the district, but being well acquainted with the country, and well aware of the necessity of something being done to improve the means of supplying water, he felt it his duty to bring to the notice of the Commissioner the advisability of enlarging this canal. The Commissioner at once forwarded this scheme on to Government, and further recommended that the work should be carried out by the person who suggested it, Major Jacob, for reasons detailed in the abovequoted letter.

6. The dimensions of the canal in 1851 were at the mouth 24 feet in breadth, and at the Noorwah (as far as which only it was then thought the new excavation should be taken) 18 feet; the banks were very irregular—in some places quite perpendicular; the depth at the mouth was 9 feet, and at the Noorwah 7 feet.

7. It was proposed to enlarge this as follows: breadth at mouth 40 feet, depth 11 feet; at the Noorwah, breadth 30 feet, depth 8 feet; the banks to have a slope of 1 in 1, a berm 6 feet wide to be on either side of the canal, and the earth excavated to be thrown back beyond the berm. The estimated cost of this was Rs. 1,30,094.

8. The Noorwah was the largest off-shoot from the Bigaree. It was dug in the time of Noor Mahomed Kulhora, and named after him. It was then carried far into the Desert north of Khanghur. The lower part had long been choked and filled up, only a trace of the old canal being left; but the upper portion, for about 9 miles, was yearly

partially cleared, that water might be conveyed to Khanghur, the head quarters of the Frontier force. The Noorwah runs about four miles to the eastward, but a small branch, the Boodwah, brought the water to the camp of Khanghur.

9. In 1851 the Noorwah belonged to His Highness Meer Ali Morad, and the annual clearance was managed by his officers. The channel was yearly getting more and more choked, and the banks were so covered with high grass and jungle, that if it had not been for the large spoil-bank on either side, the canal would scarcely have been visible. As long as it remained in this state, one of the objects of the enlargement of the Bigaree was mainly defeated, viz. that an early and ample supply of water should reach the camp of Khanghur and rising city of Jacobabad. Major Jacob therefore recommended, in June 1852, that this canal should likewise be enlarged and properly cleared for a distance of fifteen miles.

10. The scheme for enlarging the Bigaree having been approved of, and Rs. 1,30,094-10-0 granted for that purpose, the carrying out of the work was entrusted to the Political Superintendent, Major Jacob. That officer immediately made arrangements accordingly; and, as in his opinion the best means of carrying out the plan, entered into one contract for the execution of the whole work with a respectable man of the country, who had before offered to take it. This person likewise furnished good security in the persons of two wealthy and influential bankers, for the proper and exact performance of his contract, and that the work should be completed to the entire satisfaction of the Political Superintendent.

11. In consequence of its being found that labour could be obtained at a cheaper rate now than when the estimate was first framed, and other points being more clearly known, in giving the contract some change in the original scheme, as laid down in paragraph 7, was made, and the following substituted. The new cut to be carried beyond the mouth of the Noorwah, as far as the village of Kouroja (vide Map). The dimensions to be as follows:—mean breadth at mouth 50 feet, and depth 9½ feet; at the Noorwah, mean breadth 35 feet, depth 7½ feet; and at Kouroja, mean breadth 15 feet, depth 5½ feet; the banks to have a slope of 1 in 1, a berm 8 feet wide to be left on either side, and the excavated earth to be thrown well beyond the berm.

12. Immediately the inundation of 1852 had subsided sufficiently,

the work was commenced by the Contractor, and, on its being visited in December, was found to have progressed very favourably, in spite of the delay that had been caused by the great sickness that autumn in Upper Sind, owing to which, workmen could not be procured in any numbers at first. Only a very faint idea can be given by description of the amount of work that had to be done. The enormous heaps of earth that had to be removed from the very edge of the banks of the old canal, the collection of years, in some places, especially where the larger off-shoots left the main feeder, towering to a height of 25 and 30 feet; the dense jungle that had to be cleared away, particularly in the first fifteen miles, before any enlargement could be commenced on,—were in themselves no light tasks, and took up no small portion of the working season. The Political Superintendent, in his report dated 24th December 1852, also says,—

> "I find that the canals leading from the Bigaree on both sides, without any exception, have had their mouths constructed with dams projecting far into the main feeder. In some instances these dams have been made to extend half way across the whole bed of the Bigaree. This practice is most injurious under any circumstances, and liable to the greatest abuse, and has been the cause of much unfairness in the supply of water to the Zemindars, without corresponding benefit to any party."

These dams were prohibited at once, and, of course, had to be removed, in many instances from the very centre of the canal, to a great distance, clear of the new excavation. To get the work completed if possible in one season, before the rise of the river Indus, the contractor sent in all directions for labourers. These flocked in from every part of the country as soon as the sickness above mentioned had passed away; and when they understood they would receive regular daily remuneration for their work in money, not according to the old system prevailing in Sind, of niggard payments in grain, a gang of 500 men (his best workmen) came from the Chandia Jagheer, to the westward of Larkhana. In spite, however, of the greatest exertions on the part of the contractor, the work could not be thoroughly completed, though very nearly so, before the river rose, and it was necessary to admit the water,—necessary, because so many people in the country, and the troops on the Frontier, were dependent on this source for wholesome water to drink. The

remaining portion of the work, therefore, was left for the ensuing season.

13. On the northern side of the Bigaree, an extensive hollow existed, called the "Sind," which, leaving the Indus a little below Kusmore, joined the Bigaree about ten miles from the mouth of the latter. At this point the bed of the Sind was even lower than the bed of the Bigaree; the water on first entering the latter, therefore, used to run uselessly into the former. To prevent this, a new strong embankment was necessary. Again, as this Sind hollow was occasionally filled from the Indus, it became a matter of importance to make use of the water that would be standing in it, after the river water had ceased to enter the mouth of the Bigaree Canal. For this purpose strong sluice-gates were made in the above embankment, so that when the water in the Bigaree fell below the level in the Sind, the gates could be opened, and by that means the supply in the lower portion of the canal kept up a month longer than it otherwise would be.

14. On the south side, between Khanghur and Bukhtiarpoor, there was also an extensive hollow. To prevent the water escaping from the Bigaree into this, the greatest care had to be taken to make the southern bank as firm as possible, and, where any breaches existed in it, to have very strong substantial bunds made.

15. A bridge consisting of three arches, centre arch 24 feet span, side arches 8 feet each, giving a waterway of 40 feet, and high enough in the centre for the largest boats to go under, was built where the Shikarpoor, Meerpoor, and Tungwanee road crosses the canal. Another, of smaller dimensions, in proportion to the size of the canal, was also built on the Jacobabad and Shikarpoor road. Two other bridges, similar to the one on the Meerpoor road, were afterwards sanctioned and built; one on the great road from Shikarpoor to Kusmore, near Shereghur, the other on the road which connects Moobarukpoor with Hummao, on the Shikarpoor road, and near to the first-mentioned place.

16. The above was the work of the season 1852-53. The length of the working season is generally not quite six months, from the middle of October to the beginning of April.

17. A great many applications for lands hitherto waste were now made, and new grants issued by the Political Superintendent, who, in July 1852, had, in addition to his Political and other duties,

the civil charge of the entire district to the north of the Bigaree Canal entrusted to him. The whole of this was now British territory; the lands within it, formerly held by the Meer Ali Morad, having been assumed by the Supreme Government in February of that year.

18. The Political Superintendent, in reporting on the inundation of 1853, remarks,—

"I may mention here two instances in which the advantages of enlarging the Bigaree have even exceeded my expectations. In the former years, the water from the great 'Sind,' and other hollows north of the Bigaree, at high flood, broke completely across the channel of the canal, swept away its banks, and injuriously overflowed an extensive tract of low country towards Shikarpoor. In order to prevent this, I was, in making the new excavation, endeavouring to strengthen the southern bank of the Bigaree in that neighbourhood by every means in my power; but any provision of this kind appears now to be unnecessary for the enlargement; and above all, the clearance, by removing the dams of the Bigaree, has caused such an increased capacity for drainage in that channel that the water was found to flow strongly into it both ways, from the south as well as the north side, and to be rapidly carried off to the westward. The capacity of the Bigaree has been doubled by the new excavation; but it has been again at least doubled by the removal of the Morees (dams) erected by the Zemindars at the mouths of the private canals leading from the main channel."

From Political Superintendent to the Commissioner in Sind, dated 2nd Nov. 1853 (copy annexed).

19. The enlargement of the Noorwah, at a cost of Rs. 25,344, was sanctioned in the end of 1852. The season was, however, too far advanced then to commence on it before the inundation set in; but after the water had subsided, the work was entrusted to the same contractor who had the Bigaree, and who had yet to complete that canal. It became thus one work. An additional grant of the sum of Rs. 10,000 was at the same time obtained, for the purpose of extending the Bigaree ten miles further to the westward of Kouroja to where the Jacobabad and Larkhana road passed.

20. The dimensions of the Noorwah where it left the Bigaree were—breadth 12 feet, and depth 7 feet, narrowing to about 8 feet in breadth and 5 feet in depth where the old clearance ended, a

distance of rather more than eight miles. It was now arranged that the capacity of the canal should be increased as follows:—at mouth, mean breadth 30 feet, depth $7\frac{1}{2}$ feet; where the Boodwah branched off, mean breadth 24 feet, and depth 6 feet; at the extreme tail, mean breadth 19 feet, and depth 4 feet; with banks having a slope of 1 in 1, with a berm of 8 feet wide on either side. The length, instead of only eight, was to be made fifteen miles, the canal being carried on to where it reached the boundary between Sind and Khelat, seven and a half miles to the north of Jacobabad (vide Map).

21. The Boodwah, formerly a most insignificant little canal, was likewise to be cleared from its mouth to the tank in the camp of Jacobabad, a distance of three and a half miles, and increased to a mean breadth of 12 feet; banks sloped, and berm as in the others, with spoil-bank thrown well back.

22. The labour in the execution of this work was not less than that required in the Bigaree: the spoil-bank at the mouth had collected to such an extent as to form a large and most conspicuous mound on either side. The deposit at the mouths of canals is always unavoidably greater than in any other part, from the check in the rapidity of the current which takes place as the water leaves the main channel; the silt then falls and forms a bank. This, however, has been very materially lessened by keeping the tails of the canals well opened, and thereby as much as possible keeping up the rate of the stream. The enormous mounds had to be removed to a distance. The banks of the canals, from long-continued careless clearance, and the action of the water on them, instead of being perpendicular, had gained a concave shape, the upper edge overhanging considerably, while the jungle and grass on either side met over the canal, making the passage along the bed almost impossible. When the works were visited in February 1854 by a party from Jacobabad, they experienced considerable inconvenience in an attempt to ride along the bed. Since its enlargement, the largest coaches might be driven in it with the greatest ease, and in the inundation, boats of the heaviest burden now come up the Bigaree and Noorwah to Surkey-ka-Koo, which has become "the bunder" of Jacobabad.

23. In one part of its course, near Ahmedpoor, the Noorwah crosses a considerable hollow, where the level of the country is much below the level of the bed of the canal. To convey the water safely beyond this hollow, strong and well made embankments were

requisite: these were most satisfactorily made by the contractor, and the water the very first season of admission was steadily kept within its own channel. Nearer the extreme tail, where the canal approaches the "Desert" (or what was once the Desert,—now land richly cultivated), the level of the country is so low that the sides of the canal had to be carefully and firmly banked up, to prevent the water flooding the whole plain, and so being wasted. The mere excavation on our part ended, as above mentioned, at the Khelat boundary, near Oomer Khan-ka-Gote; but, at the suggestion of the Political Superintendent, the Khelat authorities carried it on a considerable distance further into the Desert, having obtained permission from him to draw as much water as they liked and could get from the tail of the Noorwah. Many new canals were taken from this feeder by the subjects of the Khan, and were the means of bringing under cultivation a considerable extent of new land, on which formerly scarcely a sign of vegetation could be seen. These lands being thus watered from the Indus, half the revenue realised on them is paid to the British Government, the remaining half being taken by the Khan.

24. Within our own territory, also, many new canals were cut from the Noorwah, and villages have since sprung up, where not many years back the inhabitants of the country scarcely ventured to take their flocks, and then in fear and trembling lest they should be swept off by the Belooch plunderers.

25. On the 1st April 1854, the work having been reported as completed, the Political Superintendent, Major Jacob, proceeded to inspect it thoroughly, and could not help feeling highly satisfied with the excellent manner in which it had been performed by the contractor. This man, a common Sindhee Maistree by trade, had of himself, unaided, save by the instructions and general directions given him by the Political Superintendent, completed seventy miles of canal excavation and embanking; had performed the work in a way fully meeting the approval of so critical a judge as the Political Superintendent, Major Jacob; and, indeed, had executed the whole work in a manner that would have done credit to a person of scientific education.

26. To keep up the communication between either side of the Noorwah, bridges were thrown across at the following places: at Goolam Ali-ka-Gote, on the Abad and Moobarukpoor road, a bridge of three arches, the centre arch having 16 feet of waterway; at

Surkey-ka-Koo, on the Jacobabad and Moobarukpoor road, a bridge of one arch, elliptical, of 24 feet span; on the great Frontier road a similar one; and four at different points lower down, having single elliptical arches, with span equal to the width of the canal, the last being at the boundary line on the road from Jacobabad to Shahpoor.

27. The Indus water was admitted into the Bigaree on the 13th April, and reached Jacobabad, a distance of fifty miles, in sixteen hours: before the clearance, the time used to be from four to five days. The supply of water was even too plentiful, for on the 15th it had filled the canal and tanks at Jacobabad to overflowing, and threatened the safety of the town and camp. The mouth of the Boodwah had to be closed, and a strong sluice-gate made, so as to regulate the supply of water. For the remainder of the season of high flood, two feet of waterway were found amply sufficient to keep the canal as full as it should be.

28. In reporting on the inundation of 1854, the Political Superintendent remarks that—

> "At the tail of the Bigaree lies a very extensive tract of land, which is now, and always has been, a desert, but which lies low, and which, with a full supply of water, would be capable of rich cultivation, and prove very productive with the smallest possible amount of labour. This land is always in great demand, and could the supply of water be increased four-fold, the present means in regard to population, &c. suffice to employ every drop of it most profitably to Government."

He therefore proposed that the tail of the Bigaree should be enlarged and extended some distance further to the westward, at an outlay of Rs. 30,000. He mentions that he had endeavoured to get the Zemindars to undertake the work themselves on their own account, and with their own private means; but though the certain profit was a most tempting inducement, yet they could not raise sufficient capital save at ruinous interest; wherefore he strongly recommended the work should be undertaken and executed by Government.

29. This project, if approved by Government, could not, however, be carried out during the season of 1854-55. The Zemindars, therefore, knowing well the value of every drop of water they could obtain, clubbed together, and of themselves made a small and shallow cutting in continuation of the Bigaree from the Larkhana road to a

distance of about twenty miles to the westward. Unfortunately, the inundation of 1855 proved a very poor one indeed, and the supply of water that reached the new cut was barely sufficient for a few crops at the upper portion,—scarcely any reached the lower part; so that they did not immediately derive much benefit from their work, though in the end it proved of considerable value, being so much of the proposed work already completed, and thereby allowing of the capacity of the canal being made so much larger than it otherwise could have been made for the sum applied for.

30. The sanction of Government for the expenditure of Rs. 30,000 having been given, a plan for carrying out that work was laid down by the Political Superintendent as follows :—

"*Memorandum regarding the proposed Enlargement of the Tail of the Bigaree Canal.*

"The canal to be not less than 24 feet wide at bottom throughout the whole length, from the bridge on the Shikarpoor and Jacobabad road to the end of the tail of the canal where it reaches the Khelat boundary near Khyra Ghuree, the whole distance being about thirty-two miles. The depth of the canal to vary gradually, according to the level of the country, that the channel may be of regular slope throughout, free from irregular rises and falls. The depth below the level of the country to be 8 feet at the bridge on the Shikarpoor and Jacobabad road, and 4 feet at the end of the canal at the Khelat boundary. The breadth at bottom being 24 feet throughout, the breadth at top, at the level of the ground, will be, at the bridge on the Shikarpoor road 56 feet, and at the end of the canal 40 feet. The earth excavated to be thrown back and spread out into a broad regular flat surface, not more than 2 feet in height above the level of the country.

"The canal, as it exists at present, is 20 feet wide at bottom at the point where the new excavation is to commence, 8 feet deep, and 36 feet wide at top. At the Larkhana road, where the present channel ends, distant from the point above mentioned fourteen miles, the dimensions of the canal now are 23 feet wide at top, 13 at bottom, and 5 feet deep. The mean sectional area of the existing channel is 157 square feet.

"Its cubic contents 157 × 73,920 = 11,605,440.

"The mean sectional area of the new canal will be 224 sq. ft.

"Its mean cubic contents 224 × 168,640 = 37,775,360.

"Total entire contents of the new excavation to be made, being the difference between the old and new channels, 37,775,360 — 11,605,440 = 26,169,920 cubic feet, giving, at Rs. 30,000 total cost, 872·33 cubic feet per rupee.

* * * * * * * *

(Signed) "JOHN JACOB, Major,
"Political Superintendent, Frontier Upper Sind."

31. It was proposed that, instead of having the work performed by contract, an attempt should be made to induce the Zemindars holding, or wishing to hold lands on that part of the canal, themselves to undertake the task, so that whatever advantage might be derived from it, whether from increased supply of water or the spreading of so much ready money among their people, they would gain the whole benefit.

32. These Zemindars were accordingly summoned to Jacobabad, the matter fully laid before them, discussed and explained to them for several days, and when they thoroughly understood the nature of the work they would have to perform, they were asked would they undertake it? They at once consented, and most cordially entered into the scheme. An agreement was accordingly drawn up, the terms of which were as will be shown presently.

33. In the first instance, the old canal was carefully measured, from the point where the new excavation was to commence up to where the Zemindars had cleared of their own accord during the past season. This measurement was very correctly made by a Moonshee belonging to the Kardarate of Jacobabad. Having thus obtained the dimensions of the old canal, the amount of excavation required could be calculated exactly, and it was found that the whole, including the removal of the old spoil-bank, which had been omitted in previous calculations, and the continuation to the Khelat boundary, could be completed at the rate of about 930 cubic feet per rupee. This rate sounds high,* but will not appear so when it is mentioned that the labourer was the person to be immediately benefited by the work, and that the work was to be so apportioned that each individual's share should be near to his land and his home, so that in carrying on his

* That is, that the amount of work done per rupee appears very great.

task steadily and quietly during the five months given, every member of his household might aid a little, and thus render the burden light on all, while all benefited by the receipt of a certain sum of ready money. That the rate was not too high is evinced by the readiness with which it was adopted.

34. The principle of the arrangement entered into was as follows:—Each Zemindar was to perform a certain portion of the work, in proportion to the area of land he held which would be watered from the new canal. A list of the Zemindars was then drawn out, showing the tenure of each. The total number of beegas of land in possession being thus obtained, viz. 233,710, and the amount of excavation being before known, viz. 26,269,920, the number of cubic feet per beega was determined at once, and found to be 112·4 ; 900 cubic feet of excavation corresponding almost exactly to the Native measurement of one "kanah," or $7\frac{1}{2}$ feet in length of the required cutting ; the term kanah was used in the agreement that it might be more easily understood by the Zemindars. It was shown them that they would receive for every kanah one rupee. The whole was to be executed in one season. If any Zemindar, by reason of indolence or carelessness, should not have his portion completed in time, it would be taken in hand by the Government authorities, and any expenditure incurred over and above the amount set down in the list as his share would be recovered from the defaulters ; each lot was to be carefully marked out with a standard kanah by the Kardar of Jacobabad the moment the subsidence of the inundation admitted of the work being commenced, and each Zemindar was then to receive one-third of his share of the money ; another third was to be paid on the work being half finished, and the remainder when it was properly and satisfactorily completed.

35. The above having been fully explained to the Zemindars, they all appended their signatures to the agreement as early as the month of May 1855, so that everything was settled long before the working season, and the Zemindars had plenty of time to make their own arrangements.

36. The length of excavation apportioned among the Zemindars amounted to 168,640 feet, to carry the canal to the Khelat boundary ; there was a further distance of 16,160 feet which was taken in hand by the Government officers.

37. To watch and assist the Zemindars in the work, a Daroga,

two Maistrees, and six Puttawallas were entertained, at a monthly outlay of Rs. 94, and this, with the general superintendence of the Kardar of Jacobabad, was the only supervision employed throughout the whole period.

38. The inundation of 1855 being a very short one, the canal was quite dry early in October, and the lots were then marked out so as to admit of the work being commenced as soon as possible.

39. In the end of December I proceeded to inspect, from Khyra Ghuree upwards, the progress that had been made. I was then able to judge thoroughly, even had I not been before aware how great and how severe the task was these people were engaged in, and I observed with the greatest pleasure and satisfaction how excellently well they were carrying on the work, and how vigorously they were devoting their energies to it. In the lower part, between Khyra Ghuree and the Larkhana road (the portion which the Zemindars the previous year had slightly cleared of themselves), though there was little spoil-bank, yet the amount of excavation was greater than in the older canal, and in some places had to be performed under the greatest difficulties. In one part the soil would be all fine loose sand, where the banks would crumble and fall in as fast as they were made, and one dust-storm would nullify the work of days, by blowing the sand back into the hollow just dug; in another part the soil would be more like rock, and in place of being easily cut and removed by means of the "powra" (or kind of large bladed hoe in common use in this country), it had to be gradually loosened, and taken out in blocks like stone. This was especially the case in one spot, part of the share allotted to one of the Belooch settlers, Dad Mahomed Khan, Jukranee, nephew of the Chief of that tribe,—quite a young man, still one whose earliest years had been spent only in the exciting employment of successful plunder. In the year 1844 he had been a principal performer in the sack of Kumber, a village only fourteen miles from Larkhana. This man, with his two brothers and their people, pointed to the soil almost in despair. When the powra touched the ground, it recoiled as if from hard rock; yet, with a little encouragement, these men steadily persevered, and ultimately finished this piece in a manner that was in no way inferior to any part in the whole work, and, when the final inspection took place, pointed with just and honest pride to the success of their

continued efforts, and to the manner in which they had overcome the difficulty.

40. From the Larkhana road to the village of Kouroja the work of excavation was great: from being of recent construction, the spoil was slight, but the original capacity of the channel was very small, wherefore the enlargement to be effected was considerable. Each lot had its busy gang of workmen, who strove one to outdo the other in the rapidity and exactness with which they would perform their task, and, by their cheerfulness and good humour, materially encouraged one another. People of every class were thus employed,—Sindhees, Brahooees, and Beloochees. The Jukranees and Kundranees, Belooch, who were brought from Kutchee by Sir C. Napier after his hill campaign in 1845, held a large tract of land watered from the Bigaree Canal to the westward of the Shikarpoor road, so that a considerable portion of the work in this part fell to their share. By the beginning of January the Jukranees had half finished their task. Among the labourers employed in their gang was one whose face seemed familiar, and on inquiry I found him to be a man by name Nooroodeen* (by tribe a Boogtee, but for some time past resident with the Jukranees), who in 1842 was considered one of the most expert and successful plunderers on the border side. Here was he now, with, in place of a sword, a peaceful hoe in his hand, and in place of applying his intelligence and strength towards rapine and murder, was devoting both with the utmost cheerfulness in the cause of peace and productiveness, and was proud and delighted at his exertions being favourably noticed and properly appreciated.

41. The old Bigaree had from years back always been carried as far as Kouroja; the spoil-bank, therefore, that had collected and required removal in this part, was very great, especially at the mouths of two large canals, the Meerwah and Moradwah. At the latter, the mounds on either side of the mouth were as high as a full-grown "bair" tree growing close by. The whole of this had to be thrown back to a distance. The course of the channel here, too, was very winding, which had to be remedied as much as possible.

* *Note by Lieutenant Colonel Jacob.*—This Nooroodeen was a notorious leader of the predatory tribes of Kutchee and the neighbouring hills; he repeatedly plundered our convoys during the first Affghan war, and was frequently pursued by, but always escaped from my horsemen, during 1841-42.

42. By the 1st June the new excavation was completed as far as the village of Vukkra,—eight miles,—but a portion of the lower part being yet unfinished, the water could not then be admitted further. On that day I proceeded with the Acting Assistant Political Superintendent, Lieutenant Briggs, and inspected the work from the bridge on the Shikarpoor road to Vukkra, taking a series of levels as we went along; the average fall proved to be 7·12 ins. per mile. By the 1st August the remainder was reported ready to receive the water, though the spoil-bank in some places had yet to be spread out evenly. This part was likewise carefully inspected to the extreme tail near Khyree Ghuree, and was found completed to my entire satisfaction; in no one spot was the work found to be under the specification. It was intended that the levelling should have been continued to the end of the canal, but the season was so far advanced, and every day of such vital importance, I did not consider myself justified in keeping the water out one moment longer than was necessary.

43. The Bund at Vukkra was cut at 7 A. M. on the 3rd August, and the water reached the furthest extremity, a distance of twenty-seven miles, by 5.30 P. M., and rapidly filled the canal. The water was then allowed an exit by the only offshoot there, the Edenwah, a canal recently excavated by Lieutenant Ford, Deputy Collector of Larkhana, for the purpose of irrigating lands in his district, which joins the Frontier one at Khyra Ghuree. The current in the Bigaree and Edenwah throughout the remainder of the season was very rapid, running at the rate of nearly three miles an hour, showing that the fall in the lower part was as great, if not greater, than it was found to be up to Vukkra, above shown.

44. Great fears were entertained by the Zemindars on the Noorwah and other large branches, that drawing off so large a quantity of water to the tail of the Bigaree would cause an excessive and dangerous diminution in the level of the water in the canals they were dependent on. This, however, did not occur in the slightest degree,—there was no perceptible difference in the level, and the supply remained equally abundant as before; the only alteration being a considerable increase in the rapidity of the current in the main channel.

45. From the above, a fact of great importance in carrying out irrigational works has been learned and proved, viz. that without altering the capacity of the upper portion of a canal, merely having it

clear and free of impediment, you may double the capacity of the tail, without lowering the level of the water in any part one inch. Besides giving an abundant supply of water, this plan of canal cutting has the further great advantage, by the increased rapidity of the current, of preventing the deposit of silt in the channel, by causing it to be carried on and spread over the lands at the tail. I believe hitherto the custom has always been to reduce the capacity of the main feeder in proportion to the number of the branches taken from it; the above fact would prove this to have been a mistaken system, as regards irrigation from the Indus. But this point I leave to others better qualified to discuss it, merely wishing to draw attention to what has here been practically proved.

46. Lieutenant Ford has lately proposed to still further enlarge and extend the canal above mentioned—the Edenwah. The execution of this work is certainly desirable: it will be the means of bringing under cultivation a large tract of country, that has been lying waste for years for want of water, and reclaim a considerable portion of what has hitherto been but too justly styled a barren wilderness, without injuriously affecting the supply of water for the lands above.

47. The subjects of His Highness the Khan of Khelat also propose carrying several canals from the extreme tail at the boundary line into the Desert west of Khyra Ghuree, so that, in a few years, this tract of country will no longer merit so dreary a name.

48. The Bigaree now presents a channel navigable by the largest boats on the Indus from end to end, a distance in a straight line of rather more than seventy-six miles. Recently, on the occasion of a present of artillery, arms, and ammunition being sent by the British Government to the Khan of Khelat, these stores, instead of having to follow the old land route from Sukkur *viâ* Jacobabad to Gundava, a journey of one hundred and twenty miles, were conveyed by boats from Sukkur up the river to the mouth of the Bigaree, and then were floated down to Khyra Ghuree, at the very end of the canal, which they reached without the least difficulty or the slightest accident. The time taken in the river was two days, and two days in descending the canal. The astonishment of the people of the country was very great, and they flocked from all directions to see the fleet of sixteen boats in the heart of the Desert, where boats never had been before. Khyra Ghuree has now become the bunder of Gundava, from which

it is distant only three marches (about forty miles), as Surkey-ka-Koo, on the Noorwah, is of Jacobabad. The berm on either side of the canal, in addition to its use as a tow-path, forms also a very good roadway for travellers from one end to the other.

49. To keep up the communication, and to prevent the banks being injured during the dry season, by men and cattle crossing, more bridges than are mentioned in the first part of this report were found necessary, and sanction was obtained for six others. These bridges were built during the past season by the same contractor who executed the work of the first Bigaree excavation. Those in the upper part of the canal are made with one elliptical arch, 40 feet span; one near Vukkra, 24 feet; and all have remained perfectly uninjured throughout the whole past inundation. The sites of these bridges are marked in the accompanying Map.

50. Since the enlargement of the Bigaree, several new villages have sprung up, even in the hitherto desolate region through which the lower portion is carried (vide Map); also a very large number of branch canals have been cut by the Zemindars to water the land about to be brought under cultivation for the first time.

51. The advantages derived from so extensive an enlargement of the Bigaree Canal are of course numerous; the principal one, being the increase of revenue, and consequent improvement in the condition of the people, requires first notice. In 1851-52, the gross revenue derived from both sides of the Bigaree and its branches amounted to about Rs. 65,000,—the exact amount cannot be given, as part of the country then belonged to Meer Ali Morad, and was farmed by him to a Native for a round sum. The very next year, 1852-53, the Bigaree had only partly been completed, and one crop produced from its water; the revenue increased to Rs. 73,127; last year it amounted to Rs. 1,18,576; and in 1857-58 it is estimated that this will further be increased to upwards of a lakh and a half. Since 1852, nearly two lakhs of beegas have been at different times given away in grants by the Political Superintendent, under the terms of the new revenue settlement introduced in the Frontier districts, that is, that an annual tax of Rs. 1-4-0 per beega should be levied on one-third of the land in possession; but to enable the Zemindar to meet the expenses he must incur in digging new canals, clearing the ground, &c., he was allowed the first year free; the second year he would pay annas 15; and afterwards the full tax of

Rs. 1-4-0. In 1857-58 full tax will be leviable on all the new grants; wherefore the revenue for that year can be pretty correctly estimated.

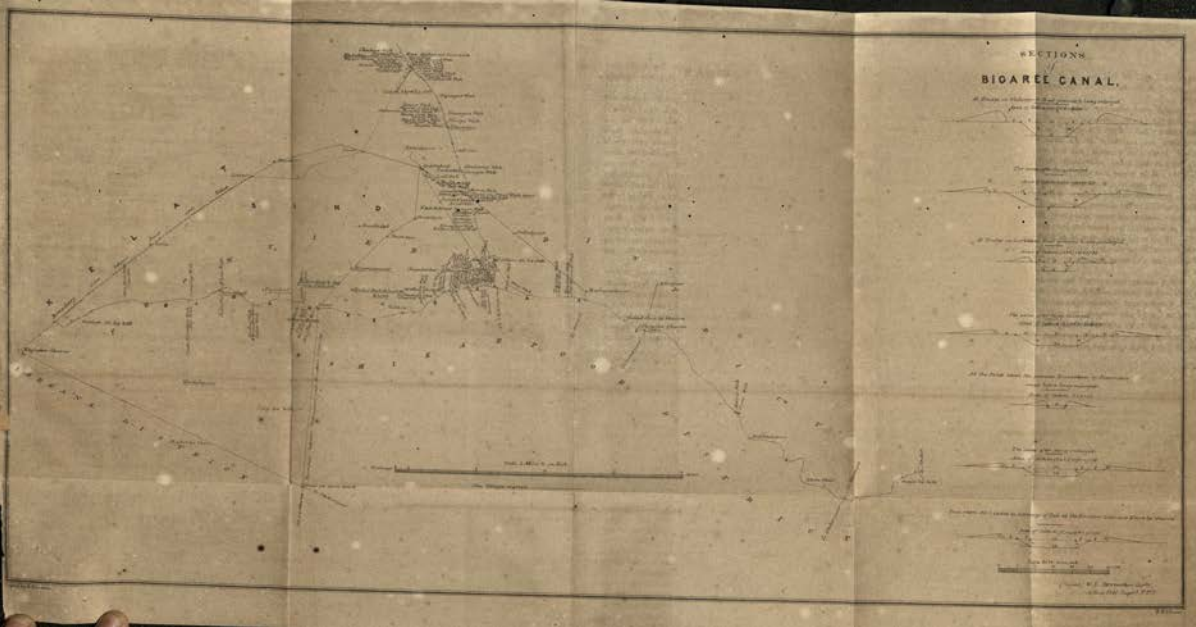
52. Another great advantage must not pass unnoticed; and that is, the effect the greatly increased supply of fresh water brought into the country has had on the wells. In 1847, before the rise of the Indus, the well-water in the camp at Khanghur (now Jacobabad) became so intensely salt that the horses even would scarcely drink it, and it had undoubtedly the worst effect on those who did, the loss in horses that year being very great. Now the water in the wells remains as sweet and pure as may be found in any well in the immediate vicinity of the river itself, and the same effect has been produced in the district generally. Further, owing to the much greater quantity of water that yearly soaks into the ground, the depth at which it is first found has been decreased 7 feet,—from 45 to 38. To aid in the introduction of as much fresh water as possible, the Political Superintendent has had two large tanks excavated, one of which last year never became dry, holding water all the year round.

53. Before closing this report, I beg strongly to bring to your notice the excellent conduct of the Kardar of Jacobabad, Khyr Shah, during the time the work of the enlargement of the tail of the Bigaree was going on; and I may honestly, and with but justice say, that it was mainly owing to his unwearied energy, his steady perseverance, and his constant activity up to the very last, even in the hottest weather, that this great work was successfully completed in so short a time.

54. I have the honour to forward herewith a Map of the country through which the Bigaree passes, and sections of the new excavation. I have also to express my regret that this report has been unavoidably delayed so long.

I have the honour to be, &c.

(Signed) W. L. Merewether, Captain,
Acting Political Superintendent, Frontier of Upper Sind.


SECTIONS
OF THE
BIDAREE CANAL.

Statement showing Amount of Excavation in the Enlargement and Extension of the Tail of the Bigaree Canal.

Sections of Canal prior to being enlarged.

	Sq. feet.
Area of Section No. 1 (20 × 8) + (8 × 8)	224
,, ,, No. 2 (13 × 5) + (5 × 5)	90
,, ,, No. 3 (11 × 2)	22
Mean sectional area previous to enlargement	112
Length of canal ditto ditto	168,640

112 × 168,640 = 18,887,680 cubic feet.

Sections of Canal after being enlarged.

	Sq. feet.
Area of Section No. 1 (24 × 8) + (16 × 8)	320
Mean area of spoil-bank removed between Shikarpoor and Larkhana roads	170
Total areas in No. 1..	490
Area of Section No. 2 (24 × 6) + (12 × 6)	216
Area of Section No. 3 (24 × 4) + (8 × 4)	128
Mean area of spoil-bank removed between 2 and 3	50
Total..	178
Area of Section No. 4 (24 × 4) + (8 × 4)	128
Mean sectional area after enlargement	253
Length of canal ditto ditto	184,900

253 × 184,900 = 46,779,700 cubic feet.

46,779,700 — 18,887,680 = 27,892,020 cubic feet of new excavation.

Rate, at an expenditure of Rs. 30,000, is cubic feet 929·734 per rupee.

(Signed) W. L. MEREWETHER, Captain,
Acting Political Superintendent, Frontier of Upper Sind.

Political Supt.'s Office, Camp Khyra Ghuree, 21st October 1856.

To the COMMISSIONER IN SIND, Kurrachee.

Dated 1st April 1851.

SIR,—In accordance with instructions received from you, I have the honour to forward herewith an estimate of the cost of enlarging the Bigaree Canal.

I have the honour to be, &c.

(Signed) JOHN JACOB, Major,
Political Superintendent on the Frontier of Upper Sind.

ESTIMATE.

Present.				Proposed.			
Breadth.		Depth.		Breadth.		Depth.	
At Mouth.	At Noorwah.	At Mouth.	At Noorwah.	At Mouth.	At Noorwah.	At Mouth.	At Noorwah.
24 feet.	18 feet.	9 feet.	7 feet.	40 feet.	30 feet.	11 feet.	8 feet.

Total length of Bigaree, from its mouth to Noorwah..... feet 183,000
Mean breadth of present canal ..... ,, 21
Mean breadth of proposed canal ..... ,, 35
Mean breadth of new excavation ..... ,, 14
Mean depth of new excavation ..... ,, 9½
Proposed mean increase in depth of the old part of the canal ..... ,, 1½
Area of section of new excavation, $14 \times 9\frac{1}{2} + 21 \times 1\frac{1}{2}$ ..... = square feet 165
Cubic contents of new excavation = $165 \times 183{,}000$ ... = cubic feet.. 30,103,500
Total cost, at 216 cubic feet per rupee .....Rs. 1,30,094

(Signed) JOHN JACOB, Major,
Political Superintendent on the Frontier of Upper Sind.

NOTE.—The water of the Bigaree Canal is shared by His Highness Meer Ali Morad and the British Government, very nearly in the proportion of ten to the former and twenty-seven to the latter.

The new excavation will be rather more than in that proportion in favour of the British Government, because nearly all the lands to the westward of the Noorwah belong to us; wherefore I am of opinion that a fair division of the cost of the proposed excavations will be as one to three, that is three-fourths to be paid by the British, and one-fourth by His Highness Meer Ali Morad. This gives—

British share.....Rs. 97,570
Meer Ali Morad's..... 32,524

(Signed) JOHN JACOB, Major,
Political Superintendent on the Frontier of Upper Sind.

To the COMMISSIONER IN SIND, Kurrachee.

Dated 21st April 1851.

Sir,—In compliance with instructions contained in your letter No. 541, of the 11th April, to my address, I have the honour to forward a rough estimate of the increase to cultivation and revenue which may be expected to accrue from enlarging the Bigaree Canal.

2. The advantages will, I am well assured, not be less than I have set forth in this estimate, but may probably be greater.

3. The plentiful supply of good drinking water for man and beast, and of improved grazing for the cattle, are also advantages which must ultimately add considerably to the revenue, although the amount cannot well be estimated.

4. As connected with this subject of the Bigaree Canal, it appears proper to bring to your notice the great advantages which would accrue from freely admitting the Indus water into the extensive hollow known by the name of the "Sind," which leaves the Indus near Kusmore, and nearly joins the Bigaree at Shereghur.

5. This canal has been wholly or partially bunded for nearly twenty years past, but even now, at high floods, its water sometimes reaches the Bigaree.

6. I am informed that formerly, when this channel was free, the water was not only brought in a very much larger stream into the Bigaree, but spontaneously overflowed the lands about Nehal, Zurkeyl, Duklee-ke-Ghuree, Khanpoor, &c., and even those close around Shikarpoor; and that such was the effect of this inundation that the water in the wells about Shikarpoor, and in the tract of country above mentioned, stood permanently about eight feet nearer the surface than at present.

7. This inundation is said to have extended also to Jaghun and the westward. The best informed of Zemindars, and others likely to be acquainted with such matters, assure me that if this inundation were again to take place annually, the profit to the revenue would be not less than a lakh of rupees.

8. The cost of freely opening the channel would be, I am assured, trifling in proportion. The bunds across this channel or hollow (the Sind) are chiefly in the British territory of Kusmore, where it leaves the river near Ghehulpoor; the remainder of the Sind is in the territory of His Highness Meer Ali Morad. Knowing the great

advantage which would accrue from re-opening this channel, I last year induced the officers of His Highness the Meer to cut a new entrance into the Sind near Budanee. When the wheat, which is now extensively grown in the bed of the hollow, shall have been reaped, the water will be admitted ; but the new cut is but 30 feet wide, and about 6 feet deep, while, to produce the full effects above mentioned, a very much larger mouth is necessary, and, certainly, the removal of the bunds across the old natural channel appears to be the best method of effecting the object in view.

I have the honour to be, &c.

(Signed) JOHN JACOB, Major,
Political Superintendent on the Frontier of Upper Sind.

Estimate of the probable Permanent Increase of Cultivation and Revenue, after the lapse of a year or two, caused by the proposed enlargement of the Bigaree Canal.

	Probable Increase of Cultivation. Beegas.	Probable Increase of Revenue. Rupees.
From the Meerzawah to the Hazarwah inclusive, on the north side of the Bigaree, the lands all belong to the British Government : in that district, in the Purguna of Moobaruk and Meerpoor, the amount of lands now lying waste, which would be brought under cultivation if the supply of water from the Bigaree were sufficiently increased, is about	30,000	36,000
The whole of the lands to the eastward and northward of the Moradwah, forming the Roopa Purguna, &c., belong to the British Government. The lands lie very low, and are capable of cultivation to any extent for which the supply of water may suffice. The greater part of this tract of country is now lying waste for want of water, the increased supply of which would bring under cultivation at least	40,000	48,000
The lands of Chodea and Sokra are Jageer, belonging to Meer Mahomed ; these are now worth about Rs. 3,000 per annum : the increased supply of water would make them worth about Rs. 7,000	...	4,000
The lands of the Abdalwah, near the village of Ummow, are shared half by the British Government and half by one Shere Sing ; they are worth about Rs. 1,000 per annum : with the increase of water they would be worth about Rs. 2,000.....	...	1,000
Total increase on lands belonging to the British Government..... Rs.		89,000

	Beegas.	Rupees.
From the mouth of the Bigaree to the Sonewah inclusive, the lands belong to His Highness Meer Ali Morad. There is a large piece of country which might be, and which was formerly cultivated in this district, but the lands are highly cultivated compared with those along the course of the Bigaree further from the river, and the increased supply of water would not bring an annual profit from these lands of more than	...	24,000
The Noorwah and its branches belong wholly to His Highness Meer Ali Morad : much low land of good quality is within the reach of its water, and the waste lands which would be brought under cultivation from its irrigation on the increase of the Bigaree could not amount to less than	5,000	6,000

Total increase of revenue to His Highness Meer Ali Morad ..... Rs. 30,000
Total increase of revenue to the British Government 89,000

Grand Total ..... Rs. 1,19,000

(Signed) JOHN JACOB, Major,
Political Superintendent on the Frontier of Upper Sind.

Khanghur, 21st April 1851.

No. 9912 OF 1851.

REVENUE DEPARTMENT.

To H. B. E. FRERE, Esq.,
Commissioner in Sind, Kurrachee.

Dated 15th October 1851.

SIR,—Adverting to your letter of the 10th June last, No. 1065, with accompaniments, I have been directed by the Right Honorable the Governor in Council to transmit for your information the accompanying copy of a despatch from the Secretary to the Government of India with the Governor General, No. 337, dated the 24th ultimo, relative to the proposal for widening and deepening the Bigaree Canal, in Upper Sind.

2. The work, I am to state, cannot be commenced at any rate until a reply is received from the Honorable the Court of Directors to the reference which the Most Noble the Governor General is about to make. In the mean while, it is desirable that you should consult Captain Turner, and report as to the advisableness and possibility of obtaining further information than has been afforded by Major Jacob as to the advantages likely to result from the work, and its probable cost.

3. The Governor in Council is likewise desirous of being informed if cultivators for so large an increase of cultivation are likely to be found on the terms estimated; also, whether the increased volume of water from the proposed enlargement of the canal is likely to suffice, as deducible from the extent of the existing irrigation, with many other points: for instance, as to how the levels have been ascertained, &c.

4. In Major Jacob's estimate, dated the 31st March last, there are apparently errors, which have been corrected in red ink in this office, so as to show the amount is Rs. 1,39,368-10-0 instead of Rs. 1,30,094.

5. As regards the suggestion for the removal of the bunds in the Sind, the Governor in Council, I am to state, would not authorise its adoption without being satisfied that the country at Shikarpoor or elsewhere would not be rendered unhealthy by the inundation.

I have the honour to be, &c.

(Signed) A. MALET,
Chief Secretary to Government.

No. 337 OF 1851.

HOME DEPARTMENT.

To H. E. GOLDSMID, Esq.,
Secretary to Government, Bombay.

Dated 24th September 1851.

SIR,—The Governor General having had under consideration the papers submitted with your letter No. 8718, dated the 1st instant, relative to the widening and deepening of the Bigaree Canal, in Upper Sind, directs me in reply to make the following communication.

2. The Governor General can have no hesitation in expressing his cordial approval of the general proposal for widening and deepening the irrigation canal above adverted to, when so many, so great, and such immediate advantages may be expected from it.

3. The question of estimate, calculations, &c. are details for which the Government of Bombay is responsible, and which His Lordship leaves to the Right Honorable the Governor in Council, without interference on his part.

4. If the work can be executed for anything like the sum named, and if it be likely to produce anything like the return anticipated, its early execution is very desirable.

5. Adverting to the very peculiar relations existing at this moment between the British Government and His Highness Meer Ali Morad, whose consent will be necessary to the commencement of any operations on this canal, which partly passes through his territory, and adverting, further, to the probability that instructions will, within a very short time, be received from the Court of Directors, which will indicate the measures to be adopted by the Government of Bombay towards His Highness, the Governor General would advise the Governor in Council not to open the question with His Highness at the present moment.

6. This act of caution cannot involve a delay of any consequence. In the mean time, the necessary sanction of the Court of Directors to the proposed expenditure will be sought.

I have the honour to be, &c.

(Signed) H. M. ELLIOTT,
Secy. to the Govt. of India, with the Governor General.

(True copy)
(Signed) A. MALET,
Chief Secretary to Government.

To the COMMISSIONER IN SIND, Kurrachee.

Dated 24th November 1851.

SIR,—I have the honour to acknowledge the receipt of your letter No. 2411, of the 17th November 1851, to my address, with accompaniment, and with reference to its subject to state :—

1. That in my opinion there is little room to doubt that cultivators will be forthcoming in numbers amply sufficient to meet the increased cultivation consequent on the proposed enlargement of the Bigaree Canal.

2. Some years ago I should, from all that I knew of the country and of its inhabitants, have had most serious doubts on this point; but the changes which have taken place in the state of the

country during the last five years (as surprising to me as they are to the Native inhabitants) suffice, in my opinion, to remove from my mind all doubt in the matter.

3. The number of inhabitants of the village of Jacobabad, I am informed by good authority, now equals that of those of the town of Larkhana. Very few of these people are from other parts of Sind; nearly all are immigrants from Kutchee, from Beloochistan, from the hills north of Kutchee, and some few from the Punjaub.

4. With the sole exception of the Murrees, *all* the tribes, of hill and plain (and even all the individuals of those tribes save eight or ten notorious robbers), who formerly followed only the profession of arms, and made plunder their chief occupation; have now taken seriously to peaceful pursuits: robbery having ceased to be successful is now fast ceasing to be respectable and fashionable among the Beloochees, and this change, of which we have as yet seen only the commencement, must alone, it appears to me (judging from what has already occurred), cause an increase in the available labour in the country sufficient to meet the increased demand.

5. The return of the Doombkees from Khyrpoor to their native country, and the town of Lharee, which has lately taken place, will, I have little doubt, be attended with the happiest effects on that part of Kutchee.

There is little or no probability of these people resuming their predatory habits, but they will enable their Chief, Belooch Khan, most effectually to protect his town (Lharee) and lands from the incursions of the Murrees, who, since the removal of Beejah Khan, with so large a portion of the Doombkee tribe, to Khyrpoor, have been in the practice of laying waste that country, and have thrice sacked and once burnt the town of Lharee itself.

6. The peace and prosperity of Kutchee again greatly affect the supply of labour available for the cultivation of lands on the British side of the border, for at seed-time and harvest great numbers of labourers appear (from time immemorial, whenever the country has been tolerably quiet) to have been in the habit of proceeding from one province to the other, to afford their aid to the farmers.

7. When making inquiries about the enlargement of the Bigaree, I conversed on the subject with some of the oldest, most respectable, and apparently best informed Zemindars of the country. They had no doubt whatever about the advantages to Government of the proposed

scheme; and it was chiefly on information received from them that I formed my own opinions on the matter.

The demands for an increased supply of water for the lands now under cultivation, especially those irrigated by canal from the Noorwah (a principal branch of the Bigaree), are most pressing. The disputes and quarrels which consequently arise are sometimes most violent, and, in the season of the inundation, are brought before me daily, and even hourly.

The enlargement of the Noorwah, which would, of course, follow that of the main feeder, would bring half the Desert under cultivation. More might be adduced pertinent to the subject of the supply of labour, but what is set forth above may be sufficient, and I wish to avoid troubling Government with unnecessary matter.

With regard to the levels, there is no doubt whatever about this part of the business, as the water flows rapidly along the present channel of the Bigaree, runs freely into all the canals from it, and at the tail of the present canal the ground falls rapidly, so that the water, if allowed to do so, would run over the surface of the ground.

The water of the Noorwah, a little beyond Ahmedpoor (a small village lately re-inhabited, one koss north-east of Khanghur), requires to be banked up, instead of having canals dug for it.

With respect to the estimate of cost of the proposed undertaking, it seems that there was an error in my figures, but independently of such errors, precise correctness was not pretended by me; neither does it appear that the general question is at all affected by the work costing a few thousands of rupees, or of pounds, more or less.

As it was, I formed my rough estimate of the outlay, and of the pecuniary value of the advantages likely to ensue from the work, chiefly on the opinions and representations of well-informed Natives of the country; and as regards my estimate of the cost, I considered it to be tolerably safe, inasmuch as a respectable and sufficiently wealthy inhabitant of Shikarpoor, accustomed to such works, expressed his willingness to undertake the execution of the work by contract, at the rate mentioned by me, and to give ample security for its due performance.

I have the honour to be, &c.

(Signed) John Jacob, Major,

Political Superintendent on the Frontier of Upper Sind.

To the COMMISSIONER IN SIND.

Dated 29th June 1852.

SIR,—With reference to Major Turner's letter No. 1111, of the 5th June 1852, to your address, and your endorsement thereon to mine, I have the honour to point out that, with deference and under submission, I have a strong opinion that the mode of executing the work of enlarging the Bigaree Canal, recommended by Major Turner, by numerous separate contracts, is by no means the best.

This method would require much superintendence,—more, indeed, than I could give to the work; it would also cause considerable delay, and would not afford good security for the whole being properly executed.

I should propose, if the work be placed in my hands, to execute it by entering into one contract for the whole with some trustworthy and respectable man of the country, taking, of course, ample security for its due and proper performance; when I should only have to examine the work minutely when finished, and we should have the value of the whole work as security for every part of it.

I think, therefore, that it will be better to allow me to manage the business as I find best.

I propose to begin the work at once, as much may be done even while the present canal is full of water.

If you approve of my views in this matter, I request the favour of your directing the Collector of Shikarpoor to make advances of cash to my order, as may from time to time be required.

I have also the honour to bring to your notice, that the chief and most important canal flowing from the Bigaree—the Noorwah—belonged, at the time when the enlargement of the former canal was proposed by me, wholly to His Highness Meer Ali Morad; it now belongs wholly to the British.

This canal must of course now be enlarged by us, as it would otherwise have been by His Highness the Meer, or a great portion of the advantage of the enlargement of the Bigaree will be thrown away.

The Noorwah formerly went more than half across the Desert, and was much broader than it is at present, the annual excavation not having been properly performed. It is, as a glance of the map will show, the most important of the secondary canals along the course of the Bigaree. It is now of about the average breadth of 12 feet, and

8 feet in depth, where it leaves the Bigaree. It requires to be enlarged to 25 feet wide where it leaves the Bigaree, and 15 feet at its other extremity, giving an average of 20 feet.

The spoil-banks are now excessively high, and are heaped up on the very edges of the canal: these must be removed, and a good slope given to the banks of the canal, with a berm of 6 feet along their top. The length of the canal to be excavated is fifteen miles, the area of the section of the earth to be excavated averages 160 feet, giving a total of cubic feet 12,672,000, to excavate which will cost, at 500 cubic feet per rupee, Rs. 25,344.

Delay in the execution of this work will cause great loss of revenue, and I have therefore the honour to request that the necessary outlay may be immediately sanctioned.

I have the honour to be, &c.

(Signed) John Jacob, Major,
Political Superintendent on the Frontier of Upper Sind.

To the Commissioner in Sind.

Dated 24th December 1852.

Sir,—I have the honour to report that I have now returned from a minute inspection of the whole course of the Bigaree Canal, and from visiting the other parts of the Frontier Districts under my charge.

I find that the work of excavating the Bigaree is progressing very favourably, notwithstanding that some delay has been caused by the late prevailing sickness.

I have been taking measures to secure all the outlets from the Bigaree Canal to the southward, where the water at high flood broke out from the canal and injuriously overflowed the country towards Shikarpoor. At all such spots strong permanent bunds are being made, while I have directed all the earth of the new excavation to be thrown up on the southern bank of the canal.

By these means there is every reason to expect that in future the water from the Sind hollow and other extensive swamps between Kusmore and the Bigaree Canal will be caused to flow solely along the channel of the latter, to the great advantage of the irrigation of the districts to the westward, instead of, as heretofore, breaking injuriously across the Bigaree to the southward.

The Indus water will of course be freely admitted into the Sind, the bunds near Kusmore, which were swept away last year, not being reconstructed. As the water in the Sind dries, its bed will be covered with wheat cultivation, while, during the inundation, numerous canals will lead from it in every direction through the country around.

I find that all the canals leading from the Bigaree on both sides, without any exception, have had their mouths constructed with dams projecting far into the channel of the main feeder. In some instances these dams have been made to extend more than half way across the whole bed of the Bigaree. This practice is most injurious under any circumstances, is liable to the greatest abuse, and has been the cause of much unfairness in the supply of water to the Zemindars, without corresponding benefit to any party.

While these dams greatly impeded the onward flow of the water in the main channel, they really added very little, if anything, to the quantity flowing into the smaller canals, which (the main channel being sufficiently full) must be regulated by the quantity drawn off from them for irrigation.

I have therefore prohibited this practice for the future, and ordered that no dams whatever be henceforth allowed to be made at the mouths of the canals leaving the Bigaree, and that no projections of any kind be permitted to be made into the main channel so as to impede the flow of the water through it.

I have requested the Collector of Shikarpoor to have this order enforced also on his side.

The work on the various roads in the course of construction through the district is progressing well, and these roads must prove of the greatest permanent benefit to the country and to the revenue. They are laying open large tracts of dense and almost impenetrable jungle, much of which will, in consequence, be immediately reclaimed and brought under cultivation.

One more little piece of road is required to connect the whole series: it is a road from Moobarukpoor to Hummao. A large bridge over the Bigaree, and ten more bridges over small canals, will be required, making the total cost of this piece of road about three thousand rupees.

The channel of the Bigaree, being enlarged, will be available for the purposes of inland navigation, which will also prove of considerable advantage.

Boats of large size will be able easily to come along it as far as the mouth of the Noorwah, while the Noorwah itself will, when enlarged to the extent sanctioned, be navigable for somewhat smaller boats as far as Surkey-ka-Koo. As the country becomes more populated, this inland navigation will become more and more valuable, and it may ultimately prove of great importance. The bridges across the Bigaree will be constructed with arches of such a size as not to impede the passage of the largest boats.

A great number of applicants for lands at present uncultivated in Boordika have appeared before me, and to these I have granted lands now lying waste and covered with jungle, on terms which appear to be most willingly accepted by the Zemindars, and which, at the same time, will ultimately prove very advantageous to the revenue.

These terms are,—the first year free; the second year one-fourth of the produce to be paid to the State; in all future years one-third.

I have endeavoured as often as possible to establish money payment of the revenue instead of Buttai; but this is not liked by the Zemindars, and cannot be carried out generally as yet.

In settling the rate of revenue to be paid in future, I have incorporated all separate petty dues, such as "Ungumwah," &c. in the share of the produce allotted to Government. Thus finding after due inquiry that these petty dues amounted to about one-twelfth of the produce, and that the cultivated lands in this frontier district heretofore have paid to His Highness Meer Ali Morad one-fourth of their produce, I fixed the collection in future at one-third—no further dues of any kind to be demanded. The Zemindars readily agreed to this arrangement, which is calculated to be convenient to all parties.

The lands of Jummal Khan Doombkee, at Koomree, were, at my request, granted to him by Mr. Inverarity for three years free; this arrangement has, of course, not been disturbed. I have appended to this report a list of the waste lands granted by me to cultivators up to this date.

But the movement among the people has as yet only commenced. There is every reason to believe that, under the present arrangements, the greater part of the whole district will speedily be brought under cultivation, and in the third year yield a full amount of revenue.

It is curious that there has been less fever during the last most sickly season in this swampy tract of Boordika than in the districts to the westward and about Shikarpoor.

It is at present very thinly inhabited, but many of the old Zemindars are returning to the country, and people are commencing to leave the Bhawulpoor territory to come and settle here; while the appearance of content and satisfaction with the change in the state of the district, and of hope for the future, among all classes of the inhabitants, is most striking. All appear eager to possess land, and to commence the work of clearing and cultivating.

Some will be supplied with the means of doing this by the money earned in working at the roads and canals now in progress; and thus I feel certain a large proportion of the amount expended on these works will be at once indirectly repaid to the State, and this in addition to, and independently of, all direct advantage.

I visited the lands about Koomree, which have been reclaimed and brought under cultivation by the Doombkees and Jekranees, the followers of Durryah Khan. The change in the neighbourhood of Koomree is quite astonishing. Two years ago the country around was covered with impenetrable jungle, through which there was hardly a path, except the roads of communication cut by me.

These men, formerly the terror of the country, and who, up to April 1847 (when I first set 500 of them to work at the annual excavation of the Noorwah), had never touched a hoe or an axe, nor handled any but weapons of war, have now cleared in the jungle round Koomree a space altogether equal to some four square miles of surface; this they have ploughed and sowed, and it is now one immense wheat-field, of great beauty and promise.

Not a hand save those of the reformed Beloochee robbers has been put to work, which presents an example alike encouraging to us and to them.

I trust that you will approve of my proceedings in the matters above reported.

I have the honour to be, &c.

(Signed) John Jacob, Major,
Political Superintendent on the Frontier of Upper Sind.

To the COMMISSIONER IN SIND.

Dated 2nd November 1853.

SIR,—I have the honour to report that, during the past season, in this frontier district, the inundation has been of full average height, or something above it.

The river, which for many years past has threatened to destroy the town of Kusmore, lately threw its whole force against its right bank, in the neighbourhood of that place. The town, with the ground on which it stood, has been completely removed, and the site is now part of the main channel of the Indus.

No lives were lost, and a new town has been commenced at a distance of a mile from the present bank of the river, westward.

The flow of water into the Sind hollow has been, this season, somewhat less than it was last year. The minor canals north of the Bigaree have received a fully average and seasonable supply, but a good deal of cotton land was overflowed late in the season, and the plants were thereby so much injured that they will, I fear, yield nothing.

All the canals leading from the Bigaree have received an unusually large supply of water this season, owing to the enlargement of that great feeder, and the removal from its bed of all the "Morees" or dams near the mouths of the minor canals.

The Noorwah, Sonewah, and Meerzawah, received last season the usual annual clearing only, I not having been able to commence the enlargement of the Noorwah before the past inundation commenced, or even to complete the ground-work of the Bigaree canal.

There is still great want of labourers, but both these works will, I trust, be fully completed before the next inundation, while the effects which have already followed the enlargement of the Bigaree are most satisfactory, and encouraging to all parties.

A full report of these works I purpose making separately, and I think that the report had better be postponed till the completion of the excavation, &c.

But I may mention here two instances in which the advantages of enlarging the Bigaree have even exceeded my expectations.

In former years, the water from the great Sind and other hollows north of the Bigaree, at high flood, broke completely across the

channel of the canal, swept away its banks, and injuriously overflowed an extensive tract of low country towards Shikarpoor.

In order to prevent this, I was, in making the new excavation, endeavouring to strengthen the southern bank of the Bigaree in that neighbourhood by every means in my power; but any provision of this kind appears to be now unnecessary; for the enlargement, and, above all, the clearance, by removing the dams of the Bigaree, has caused such an increased capacity for drainage in that channel that the water was found to flow strongly into it both ways, from the south as well as from the north side, and to be rapidly carried off to the westward.

The capacity of the Bigaree Canal has been about doubled by the new excavation, but it has been again at least doubled by the removal of the morees erected by the Zemindars at the mouths of the private canals leading from the main channel.

The prejudice regarding these morees, and the difficulties I met with therefrom in their removal, will be explained in my report on the work of the canal. It will suffice to mention here that these prejudices were not confined to the Natives, and that they were so inveterate, that when they knew that I had positively determined wholly to remove every particle of dam, several of the chief Zemindars on the south side of the Bigaree refused or neglected to make the usual annual clearance of their canals, leaving them totally untouched, and giving out that as the removal of the morees would prevent their getting a drop of water, they would do nothing to the canals, for every rupee expended on them would be wasted.

Such, however, proved to be the increased supply, owing to the free clearing and opening of the main channel, that the water, even in these uncleared canals leading from it, stood two feet higher than usual, and, in many instances, had to be banked out of the fields.

Several of the most violently prejudiced Zemindars, not holding land in the district under my charge, or in any way subject to my authority, have voluntarily come to me to confess their error, and their unreasonable opposition, and to return thanks for the work accomplished.

The complete exposure of the fallacy of their strong prejudices in this instance must, I think, be of great benefit generally among the country folk.

The effect solely due to the greater *height* to which the water rose this year, by reason of flowing freely in the main channel, has been surprisingly great. Thus the land, supplied with water from the Bigaree, cultivated last season in *excess* of that of former years, amounts to more than eight thousand beegas, while the *decrease* in the number of wheels employed amounts to three hundred and thirty. Each wheel kept at work costs about Rs. 130 per season, so that the saving to the cultivators on wheels alone has already amounted to more than Rs. 40,000, leaving the increased cultivation wholly out of consideration.

The completion of the work on the main feeder, from tail to mouth, the enlargement of its chief branch, the Noorwah, and its prolongation far into the Desert, all of which will be, I trust, finished before next April, cannot but be attended with the most happy effects on the revenue and the people of the country.

The return to Government for its outlay is certain, and must be very great; but, from the very nature of such works, time is absolutely necessary fully to develope their beneficial effects.

It is especially so in this country, where, up to the year 1848, the few inhabitants walked in fear and trembling, and were too much occupied with their own personal danger to pay much attention to the tilling of the ground.

The great want in the country now is population. The district is comparatively but very thinly peopled, while the inhabitants suffer much from fever in the eastern part of it; and I take this opportunity of observing that it would be an undoubtedly profitable proceeding, as well as most humane, if Government would sanction an arrangement whereby some trifling medical aid could be afforded to the sufferers.

On the 3rd of July last, one and a quarter inch of rain fell at Jacobabad; the total fall since the 1st January 1853 having been 1·66 inches.

The absence of rain in this district is a decided advantage, as regards the health of the inhabitants, while it is certainly not injurious to the cultivation or revenue.

Certain Zemindars on the border, subjects of the Khan of Khelat, are, with my permission, making canals, from both the Bigaree and Noorwah, the former to supply the lands near Rojan, and the other leading into the heart of the Desert, ten miles north of Jacobabad.

One-half of the revenue of all lands so cultivated beyond our frontier boundary comes to the British Government; but to what extent these operations may affect the revenue cannot yet be determined.

I have the honour to be, &c.

(Signed) JOHN JACOB, Major,
Political Superintendent on the Frontier of Upper Sind.

No. 100 OF 1854.

From Major JACOB,
Political Superintendent on the Frontier of Upper Sind,

To the COMMISSIONER IN SIND.

Dated 1st June 1854.

SIR,—I have the honour to report that the excavation of the Bigaree and Noorwah Canals has been now completed throughout their entire length.

2. The supply of water thereby afforded is much greater even than I had anticipated. The tails of both these large canals are kept freely open, the water flowing over the Desert to the west from the Bigaree, and northward from the Noorwah. Notwithstanding the free exit, the supply has been already found so great that the small canals at Jacobabad overflowed; and to protect the town and camp, I have had to construct sluices at the mouths of the Boodwah and Rajwah where they leave the Noorwah Canal.

3. This arrangement proves perfectly safe and effective; but as the river may be expected to rise much higher than at present, it will also be necessary, I think, to construct an "escape" of pukka masonry on the Noorwah near Ahmedpoor, about two miles north of Jacobabad. An application for sanction for this work I purpose forwarding hereafter, should experience during the present season confirm my opinion as to its necessity.

4. A very large tract of hitherto desert and waste land is already being brought under cultivation by reason of the enlargement of these canals, but a full report on the work, with plans, levels, &c. shall be forwarded as soon as I can prepare it, wherefore it seems unnecessary to enter into further particulars at present.

5. The bills for the cost of the work executed I have the honour to forward for your counter signature.

I have the honour to be, &c.

(Signed) JOHN JACOB, Major,
Political Superintendent on the Frontier of Upper Sind.

Jacobabad, 1st June 1854.

No. 390 OF 1854.

REVENUE DEPARTMENT.

From H. B. E. FRERE, Esq.,
Commissioner in Sind,

To the Right Honorable Lord ELPHINSTONE, G.C.H.,
Governor and President in Council, Bombay.

Dated 20th November 1854.

MY LORD,—In submitting the accompanying copy of report from Major Jacob, Political Superintendent on the Frontier, No. 209, of the 13th instant, on the extent of irrigation during the past year, and recommending that the tail of the Bigaree be extended, I have the honour to request the sanction of your Lordship in Council to the expenditure of a further sum of Rs. 30,000 to widen and extend for about ten miles the tail of the Bigaree Canal. On the calculation given by Major Jacob, the correctness of which I see no reason to doubt, the outlay can only be regarded as an advance to be repaid in a very short term of years.

I have the honour to be, &c.

(Signed) H. B. E. FRERE,
Commissioner in Sind.

Commissioner's Office, Camp Jerruck, 20th November 1854.

No. 209 of 1854.

From Major Jacob,

Political Superintendent on the Frontier of Upper Sind,

To the Commissioner in Sind.

Dated 13th November 1854.

Sir,—I have the honour to report that during the past season, in the Frontier District, the inundation of the Indus has been most favourable. It has been of the full average height, and of remarkable steadiness.

2. The water entered the Bigaree Canal on the 13th April, and from that date to the 25th September, on which date the river left the mouth of the canal, the flow has been continuous, and without any considerable fluctuations as regards the level. The supply of water at the tail of the Noorwah Canal has been very good, and has irrigated a very large tract of the old Desert, both without and within the British boundary. At the tail of the Bigaree Canal the supply of water has been as much as the present canal could bring down, but has been by no means equal to the demand.

At the tail of the Bigaree Canal lies a very extensive tract of land, which is now, and always has been, desert; but which lies low, and which, with a full supply of water, would be capable of rich cultivation, and prove very productive with the smallest possible amount of labour.

This land is already in great demand, and could the supply of water be increased four-fold, the present means in regard to population, &c. suffice to employ every drop of it most profitably to Government.

The present main channel of the Bigaree, before its great branch, the Noorwah, leaves it, is certainly capable of bringing down more water than the tail now carries off, and the more rapid the flow through this main channel, the less is the deposit, and consequent cost of annual clearance. I therefore strongly recommend that the tail of the Bigaree, that is that portion of the canal westward of the point at which the Noorwah leaves it, be enlarged from 16 feet at bottom and 28 feet at top, about its present average dimensions, to 24 feet at bottom and 36 feet at top, and extended in length ten miles further into the heart of the Desert.

This work could be accomplished, I think, for Rs. 30,000, and would ultimately return to Government thirty per cent. of this outlay annually.

There is now no room to doubt of this result, for the revenue report of the district for the last year shows that lands have already been granted in the Desert, consequent on the new supply of water, to the extent of more than 180,000 beegas, which two years hence will yield a permanent revenue of about Rs. 70,000, or about fifty per cent. on the cost of the enlargement of the Bigaree Canal.

I have been endeavouring to get the Zemindars to undertake the work themselves on their own account, and with their own private means. The certain profit was a most tempting inducement, but, however willing, I find that the people have not the means of obtaining the necessary capital, except at ruinous interest; and on the whole view of the subject it appears to me that the work is one which should be executed, and which would be most wisely undertaken, by Government.

The losses and gains by alluvion and diluvion during the last season have been very trifling; about 1,000 beegas were carried away, of which 350 beegas were under cultivation, and about 1,700 beegas have been thrown up, of which 700 are fit for cultivation.

I have the honour to be, &c.

(Signed) JOHN JACOB, Major,
Political Superintendent on the Frontier of Upper Sind.

Political Superintendent's Office, Jacobabad, 13th November 1854.

Comparative Statement, showing the Increase of Revenue on Lands watered by the Bigaree Canal, in the Frontier and Shikarpoor Districts, consequent on the enlargement of that Canal.

Districts.	For the Year 1852-53.	For the Year 1857-58.	Total Increase of Revenue.	Cost of enlarging Bigaree and Noorwah Canals.	Cost of Building Canals.	Total of Expenditure.
FRONTIER DISTRICTS.	*Rs. a. p.*	*Rs. a. p.*	*Rs. a. p.*	*Rs. a. p.*	*Rs. a. p.*	*Rs. a. p.*
Net revenue from Bigaree and offshoots previous to the enlargement, from lands on the northern side of the main channel	24,129 8 2	.....	.....	.....	.....	.....
Estimated amount realisable on old grants.....	.....	25,900 6 9	.....	.....	.....	.....
Estimated amount realisable on new grants at Rs. 1-4-0 per beega, one-third of the extent of land being under cultivation	.....	81,040 0 0	82,710 14 7	1,53,000 0 0	9,000 0 0	1,62,000 0 0
SHIKARPOOR DISTRICTS.						
Gross revenue from Bigaree and offshoots previous to the enlargement, from lands on the southern side of the main channel	23,815 4 9	.....	.....	.....	.....	.....
Estimated amount realisable on old grants, *i. e.* on land within the enlargement	.....	29,000 0 0	.....	.....	.....	.....
Estimated amount realisable on new grants at Rs. 1-4-0 per beega, one-third of the extent being under cultivation	.....	.....	5,184 11 3	.....	.....	.....
Total.....Rupees	47,944 12 11	1,35,940 6 9	87,895 9 10	1,53,000 0 0	9,000 0 0	1,62,000 0 0

MEMO.—Amount in beegas of new grants since the enlargement of the canal up to the 15th March 1855.....189,137
A third of this number of beegas will be yearly brought under cultivation, and will pay money rate at Rs. 1-4-0 per beega, excepting lands watered from the Bigaree, in the territory of the Khan of Khelat, which will pay annas 10 only to the British Government.

(Signed) JOHN JACOB, Major,
Pol. Supt. on the Frontier of Upper Sind.

(Signed) W. L. MEREWETHER, Lieutenant,
Assist. Pol. Supt. on the Frontier of Upper Sind.

Jacobabad, 29th March 1855.

No. 238 of 1856.

To the Superintending Engineer in Sind, Kurrachee.

Dated 17th July 1856.

Sir,—I have the honour to forward the undermentioned proposition for irrigational improvement in the Frontier District, by enlarging and thoroughly clearing out the Meerzawah, a large offshoot from the Bigaree.

2. The Meerzawah has hitherto been left to the Zemindars to clear annually; but it being beyond their power to do so, I have this year applied that it should be cleared at Government cost.

3. From neglect, the canal has become much choked, and the spoil-bank being close to the edge of the canal, continually falls into and fills up the channel.

4. To ensure a full return for the annual Government expenditure, I would propose that the canal be put in thorough good order, the channel cleared, banks sloped, and the spoil-banks thrown back some distance. This will not cost a very large sum, and will be doubly advantageous, first, by adding largely to the revenue, owing to the increased supply of water, and secondly, by decreasing the amount otherwise requisite for the annual clearance.

5. This canal waters the lands belonging to the following villages:—

Meerpoor.	Gonia.
Chandran.	Meerul-ka-Gote.
Chunria.	Laooree.
Chuttah Omer-ka-Gote.	Deeah.
Soliman Bubber-ka-Gote.	Jallalpoor, and Moobarukpoor.

Last year, notwithstanding that no clearance of the canal was made, beyond a little just at the mouth, the Government net revenue amounted to Rs. 9,750, and an additional Rs. 1,950 was added by Jageerdars, making a total of Rs. 11,700: with the supply of water which the proposed improvement would give, this revenue would be more than doubled the first year, the only check to more extensive cultivation hitherto having been the want of water.

6. At present the Meerzawah leaves the Bigaree canal about two and a half miles to the eastward of Soojra-ka-Gote. From this

point to near Meerpoor, a distance of about nine miles (measuring in a direct line), the canal runs almost parallel with, and quite close to the main feeder, the Bigaree, and is carried through a tract of country on which not a blade of cultivation has ever been raised; neither would this part of the canal ever be required, even should any one wish to bring the land under the plough, for water could always be obtained from the Bigaree immediately adjacent.

7. For nearly nine miles this part of the canal is perfectly useless, and any money expended thereon would be simply wasted. The reason for its being taken from the Bigaree so high up is the Native belief that the further the head of a canal is taken up the main feeder, the more water they will get. If this were done to obtain a high level for the head, that they might adjust the fall in their own canal to the best advantage, there would be some reason in it, but they have no means for doing this.

8. About nine miles (measuring along the canal) lower down the Bigaree than where the present Meerzawah leaves it, the first mentioned canal takes a considerable bend to the north, and there approaches to within about 2,500 yards of the Meerzawah. I would therefore propose that a new mouth be made at this point, the dimensions to be as follows:—depth 9 feet, width at bed 14 feet, with a slope of 1½ to 1 of depth, making the width at surface 44 feet.

The sectional area will be (14 × 9) + (13·5 × 9) = 247·5; 247·5 × 7 500 = 1,876,250 cubic feet. At the present rate of wages, viz. one rupee for every 700 cubic feet of excavation, the cost would be Rs. 2,680-5-8.

9. From where the new mouth will join the old canal to the extreme tail near Moobarukpoor is a distance of fourteen miles. This portion I would propose to clear, and enlarge, as follows:—width of bed, where new mouth joins, 14 feet, gradually decreasing, as the water is drawn off by various canals, to 8 feet at the extreme tail. First depth of 9 feet gradually decreasing, till at the tail it would be 5 feet; slope, as in the mouth, 1½ to 1 foot.

Sectional area at mouth	247·5
Ditto at tail	77·5
Mean sectional area	162·5

162·5 × 73,920 = 12,012,000 cubic feet.

Dimensions of the old canal—

12	feet	wide at mouth.....	Bank perpendicular.
4	„	„ at tail	
8	„	deep at mouth.....	
4	„	„ at tail	

Mean sectional area 8 × 6 = 48 ; 48 × 73,920 = 3,548,160 cubic feet. Deducting this from cubic feet 12,012,000 there remain 8,463,840 cubic feet of excavation to be done; and at the rate of one rupee for every 700 cubic feet of excavation the cost would be ..... Rs. 12,091 3 2
Adding new mouth 2,680 5 8

Will make a total of ... Rs. 14,771 8 10

10. As there will, probably, next season be a great demand for labourers throughout Upper Sind, it will be a matter of great importance that this work, if sanctioned, should be begun as soon as possible, to prevent hurry in its carrying out. The canal will be quite dry by the middle of October, when the work might be commenced.

11. Once cleared, as above proposed, Rs. 2,500 would amply suffice for the annual clearance of this canal.

12. I have the honour to annex a sketch map of the part of the country through which the Meerzawah runs.

I have the honour to be, &c.

(Signed) W. L. Merewether, Captain,
Acting Political Superintendent, Frontier of Upper Sind.

Political Superintendent's Office, Jacobabad, 17th July 1856.

No. 1649 of 1856.

Public Works Department.

Report by the Superintending Engineer in Sind.

There can, I conceive, be no doubt of the advantage to Government of undertaking works of this description: in the present instance, for an outlay of Rs. 14,771, a net annual return to Government of

Rs. 7,250, or nearly fifty per cent., is promised. The work is simple, and easy of execution, and there are only two points on which any doubt occurs to me, both of which your intimate knowledge of the Bigaree Canal, and of the system you are now introducing, will enable you at once to settle.

2. The first is, whether the dimensions and state of the Bigaree above Soojea, and between it and the proposed new head for the Meerzawah, will enable the large volume of water the Meerzawah will withdraw to pass through the upper part of the canal, and more especially through those nine miles of the Bigaree in its present state, without affecting the supply in that canal below the head of the Meerzawah. It is, I think, clear that a very large increase of water cannot be withdrawn from the Bigaree for the Meerzawah without reducing the volume in the Bigaree below the junction, and that, if the dimensions of the Bigaree be now properly regulated, the shifting of the mouth of the Meerzawah nine miles lower down it will still further affect that volume, and that it will only be safe to do so if at the same time the area of the Bigaree itself be enlarged sufficiently to convey, in addition to its present volume, the additional volume that will be drawn off by the Meerzawah when enlarged as proposed, otherwise there will be in the Bigaree, beyond the new head of the Meerzawah, a diminution of level. It is, however, possible, that the quantity of water in the Bigaree beyond the junction is in excess of what is required, or that its area of section and slope may be the same from above the present head of the Meerzawah to the site of the proposed head, in which case the supply in the Bigaree below the new head would be affected only to the extent of the greater volume drawn off by the new Meerzawah that is taken by it at present.

3. The other question is, whether it would interfere with the general question of canal clearance to consider a canal of only 14 feet at bottom a main feeder, and to authorise its clearance at the expense of Government.

(Signed) H. B. Turner, Lieutenant Colonel,
Superintending Engineer in Sind.

Kurrachee, 24th July 1856.

No. 293 of 1856.

Public Works Department.

From the Acting Commissioner in Sind,

To the Right Honorable Lord Elphinstone, G.C.H.,
Governor and President in Council, Bombay.

Dated 28th July 1856.

My Lord,—Captain Merewether, Acting Political Superintendent on the Frontier of Upper Sind, has forwarded through the Superintending Engineer a scheme for clearing and enlarging the Meerzawah Canal, one of the large offshoots from the great Bigaree Canal, in the Frontier Districts.

2. I have the honour to forward herewith in original Captain Merewether's letter, and the remarks of the Superintending Engineer in forwarding it to me.

3. The subject is one on which I possess full personal knowledge; the locality generally, and this particular canal, having been familiarly and minutely known to me for fifteen years past.

4. The Meerzawah was always a Government canal under the Meers. After the deposition of Meer Roostum, it lay wholly in the territory of Meer Ali Morad until the resumption of the district from that Prince in 1852, when it came under the British Government.

5. The Meerzawah was formerly one of the chief branches of the old Bigaree, and supplied a considerable tract of valuable and fertile ground: its clearance must always have been important in an economical point of view, for the return on the outlay must have afforded large profit.

6. But while under the rule of the Meers, a very large portion of the Government revenue payable from the land watered by this canal was alienated and given in life Jageer to various private parties.

7. On the district becoming British territory, and on the enlargement of the Bigaree Canal, I did not recommend that the Meerzawah should be cleared at Government expense, because not only was a large portion of the revenue derivable from it then alienated

from the public treasury, but the canal itself, from long neglect and imperfect annual clearance, was in such a state that the cost of restoring it to a good working condition would have been unusually great.

8. There were also more important irrigational works on hand in the Frontier Districts, and it remained to be shown by experience what quantity of water the great main feeder, the Bigaree, in its enlarged state, could supply.

9. Since the time when the district came under our rule, several of the Inam grants held on this canal have lapsed: a great demand for new land to be watered by it has arisen.

10. The Bigaree is certainly able to supply the water, and the increased drain from this main feeder will prove advantageous to it. Near the mouth of the Bigaree extensive floods often prevail over a tract of country through which this canal passes for several miles of its course: these floods have occasionally broken across the Bigaree, and done much injury to its banks, but it has been found of late years, that whatever tends to increase the rapidity of the current in the canal prevents this injurious effect of the flood, which, when the stream is rapid, flows both ways into the canal instead of breaking across it.

11. Drawing off more water lower down the canal is equivalent to increasing its fall, and thus augments the velocity of the stream above, while the floods near the mouth, during the inundation, are so extensive as to keep the head always near its full height, however rapid the stream.

12. I have now observed this to take place during so many years that it is certain that the more water we can draw down the Bigaree Canal the better, and that the supply for the proposed improved Meerzawah leading from it will be ample.

13. With regard to the new mouth to the Meerzawah proposed by Captain Merewether, I am aware that the proposal also is very judicious, for it will effect a saving of some nine miles in length of the work of excavating the canal, while the difference of level between the new and old mouth is so small that the head of water will not be perceptibly influenced by it.

14. There is no doubt but that the proposed work would return fifty per cent. annually on its cost, as estimated by Captain Merewether.

15. It is also certain that the Meerzawah is properly, and must remain, a Government canal, to be cleared annually, like the other main feeders, at Government expense.

16. It appears to me very advisable that the work should commence in October next. I have therefore the honour respectfully to recommend that immediate sanction be given for the expenditure of a sum not exceeding Rs. 15,000 on clearing and enlarging the Meerzawah Canal, as proposed by Captain Merewether.

I have the honour to be, &c.

(Signed) JOHN JACOB, Lieutenant Colonel,
Acting Commissioner in Sind.

Commissioner's Office, Kurrachee, 28th July 1856.

Report by the Chief Engineer of Public Works.

No. 6519 OF 1856.

PUBLIC WORKS DEPARTMENT.

Office of Chief Engineer of Public Works, Bombay, 18th August 1856.

There can be no doubt, as stated by Lieutenant Colonel Jacob, that the increased drain from the main feeder, consequent on the clearance of the Meerzawah, will be equivalent to increasing its fall in the former, or Bigaree Canal; and as it is stated by Lieutenant Colonel Jacob that there is a superabundance of water at the head of the Bigaree, which, at the time of floods, is the cause of serious injury to the banks of the canal, I should think that this evil will be diminished by the clearance of the Meerzawah, and thus drawing off more water from the Bigaree.

2. At the same time, it is more than probable that the present channel of the Bigaree Canal, both above Soojea and from thence to the proposed new mouth for the Meerzawah, will, as suggested by Lieutenant Colonel Turner, be found insufficient to furnish a full supply both to the Meerzawah and to the lower part of its own channel. Indeed, I consider the fact of the Meerzawah having been

originally led off from near Soojea as proof conclusive that the Bigaree Canal between Soojea and the proposed new mouth was not then large enough to supply both. There is, therefore, in my opinion, a strong likelihood that it may be found necessary to enlarge the Bigaree Canal as far down as the new mouth, in addition to the work estimated for by Captain Merewether.

(Signed) C. WADDINGTON, Major General,
Chief Engr. of Public Works.

Resolution of Government on the above, No. 2329, *dated the 2nd September* 1856.

As Lieutenant Colonel Jacob certifies from his own personal knowledge that the Bigaree Canal can supply the Meerzawah as proposed, without detriment to its own supply, Government approve of the provision for the proposed cut being made in the general statement preparatory to the next Budget.

(True copy)

(Signed) W. HART,
Secretary to Government.

Resolution of Government No. 473, *dated* 17*th February* 1857, *on the Letter from the Acting Commissioner in Sind, No.* 462, *dated* 6*th December* 1856.

The Right Honorable the Governor in Council has perused with much pleasure the accompaniments to the Acting Commissioner's letter No. 462, dated 6th December 1856, which should be published as a Government Selection.

2. Captain Merewether, whose merits Government have often before had reason to notice, seems, in his connection with the Bigaree Canal, to have fully deserved the encomium contained in paragraph 3

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